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(54) POLYPROPYLENE HEAT-FUSED FIBER AND NONWOVEN FABRIC

(57)Abstract:

PURPOSE: To obtain a thermally fusible fiber not having a waxy touch but having a dry and soft skin touch as a single layered thermally fusible fiber easy in the production, and having a high fusion strength even fused at a relatively low temperature, and to produce a thermally fused nonwoven fabric from the same.

CONSTITUTION: A polypropylene thermally fusible fiber is produced from a resin composition comprising a polypropylene resin and silica and/or a fatty acid amide in an amount of 0.1-3.0wt.% based on the polypropylene resin and having a lower crystallization heat generation-starting temperature [TCS (°C)] than a value calculated by an equation: $TCS (°C) = 0.094CE2 - 4.13CE + 127$ (CE is an ethylene content %), and a polypropylene thermally fused nonwoven fabric is produced.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] this invention has the touch entirely made soft, heat weld is comparatively possible for it at low temperature, and since weld intensity is strong, it relates to the polypropylene system heat weld nonwoven fabric manufactured from polypropylene system heat weld fiber and it excellent in processability.

[0002]

[Description of the Prior Art] Hygienic goods, such as a disposable paper diaper and a napkin, have come to be widely used by advance in society of a woman, change of a living environment, etc. Since such material is what touches the skin of people with the weak skins, such as infants and a woman, directly, it excels chemical-resistant and it is required that a toxic substance is not included, that it does not deteriorate, that the touch should be softly good, etc. Since a binder is not used for the heat weld nonwoven fabric manufactured from heat weld fiber and it in the manufacture process and it does not contain the matter detrimental to human bodies, such as formalin, it is suitable as facing of hygienic goods, such as a paper diaper and a napkin. Besides being excelling chemical-resistant, a soft thing, etc. since it can carry out heat weld at low temperature comparatively, especially the heat weld fiber of a polyolefine system is suitable for mass-producing, has turned to these uses very much, and is widely used for them with the gestalt of a nonwoven fabric.

[0003] Although there is a fault from which a manufacturing process becomes complicated as compared with a monolayer fiber system especially about the nonwoven fabric manufactured from the compound heat weld fiber and it which are formed from two sorts of polymers from which the melting point differs, since high heat weld nature is obtained even if it is heat weld at low temperature, much proposals are made. For example, the bicomponent fiber of the polyolefine system allotted to the parallel connected type or the sheath-core type does not contain a toxic substance, but since heat adhesion can be carried out, and feeling is flexible and comparatively excellent in low temperature chemical-resistant, this kind of heat weld nature is most used abundantly as various kinds of objects for nonwoven fabrics, so that JP,50-4767,B, JP,52-12830,B, or JP,55-483,B may see.

[0004] On the other hand, heat weld will not be carried out, if heat weld nature is bad and is not an elevated temperature in the monolayer fiber obtained only from the homopolymer single taste of polypropylene in the easy monolayer fiber of a manufacturing process. For this reason, usually manufacturing the fiber of sheath-core structure or a syntropy as a bicomponent fiber is performed. For sheath-core type fiber, it is performing carrying out heat weld of a sheath component, without giving and carrying out heart component melting of the melting point difference by selecting the resin of the low melting point for a sheath component to the resin of a heart component. It is performing carrying out heat weld by the resin of the low melting point by constituting from a single fiber of the resin to which components differ and parallel-connected-type fiber also has a difference in the melting point. Although many composite-ized heat weld fiber by the combination of gay polypropylene / copolymerization type polypropylene is manufactured especially, in order to raise the heat weld nature of heat weld fiber, it is necessary to lower the melting point using the copolymerization polypropylene which made [many] the ethylene content as much as possible.

[0005] It becomes easy by enlarging a melting point difference with gay polypropylene to heat weld this, weld intensity becomes large, it increases the intensity of the heat weld nonwoven fabric itself, and split-ization of it is still also attained. however, the feeling of slime at the time of the slime on the front face of fiber becoming large, so that the rate of a comonomer increased, and making it a heat weld nonwoven fabric -- it is -- as the facing for hygienic goods, such as a paper diaper and a napkin, -- -- entirely, it can be hard to obtain admiration", and when it contacts, it comes to give displeasure moreover -- although it will be slimy if the rate of a comonomer is reduced conversely, and admiration decreases -- heat weld temperature not only rising but weld intensity -- falling -- -- the performance requirement of both heat weld nature could be easily incompatible with admiration" entirely

[0006]

[Problem(s) to be Solved by the Invention] Even if manufacture is heat weld fiber of an easy monolayer, this invention has the soft touch of the sensibility which there is no feeling of slime and was carried out entirely, has chemical resistance, and aims at development of the heat weld nonwoven fabric comparatively manufactured from heat weld fiber and it with high weld intensity also in heat weld of the degré of low temperature.

[0007]

[Means for Solving the Problem] this invention adds silicas and/or fatty-acid flax id 0.01 to 3.0% of the weight to polypropylene resin, and the start temperature (TCS (degree C)) of crystallization generation of heat is the following formula (1).

$$TCS (\text{degree C}) = (0.094CE2 - 4.13CE + 127) ** \dots (1)$$

(however CE are ethylene content %, and are $0 \leq CE \leq 8\%$. The above-mentioned purpose was attained by developing the polypropylene system heat weld nonwoven fabric which was calculated by) and manufactured from the polypropylene system heat weld fiber using the resin constituent which is reliance low temperature, and this polypropylene system heat weld fiber.

[0008] The gay polypropylene with which the polypropylene resin used for this invention was manufactured only from the propylene, It is polypropylene which copolymerized ethylene less than 8% as a comonomer. although it is not necessary to limit especially if melt spinning is possible -- usually -- 2-1000g of melt flow indices, and 10 minutes (JIS K-7210 table 1. condition 14; -- 230 degrees C of test temperatures) test load 2.16kgf -- desirable -- 5-80g -- it is resin for 7-60g / 10 minutes still more preferably for 10 minutes Although it will not matter if it is silicas usually used, such as a silicon dioxide and a natural silica, as silicas added to polypropylene resin, feeling like [there is very few feeling of slime and] the hide of **** as tactile feeling is easy to be obtained, and heat weld intensity also increases effectively what added the silicon dioxide also in these. About grain size, the thing 50 micrometers or less of dispersibility is well desirable. Moreover, if the erucic-acid flax id, the oleic acid flax id, stearin acid flax id, etc. are the fatty-acid amides usually used as fatty-acid flax id to add, it will not matter. Especially the thing that added the erucic-acid flax id also in these excels [flexibility] in tactile feeling equivalent to increase and the skin very much. Moreover, heat weld intensity also increases effectively.

[0009] Start temperature of crystallization generation of heat which measured these additives using DSC (Differential Scanning Calorimetry) of the polypropylene resin constituent blended and obtained to polypropylene resin (TCS (degree C)) (TCS (degree C) $= (0.094CE^2 - 4.13CE + 127) ** \dots (1)$) (however CE are ethylene content %, and are $0 \leq CE \leq 8\%$ it calculates by) -- having -- reliance low temperature -- desirable -- TCS(degree-C) $= (0.094CE^2 - 4.13CE + 125) ** \dots (2)$)

It is come out and calculated and the resin constituent which is reliance low temperature is used. If it is in a resin constituent with the start temperature of crystallization generation of heat higher than the temperature which is gay polypropylene and was calculated by the formula (1), the temperature whose heat weld is attained is also of the same grade compared with conventional polypropylene, when it is made a heat weld nonwoven fabric, the intensity of heat weld of the nonwoven fabric itself is also weak, and it cannot be used for the use which needs intensity. Moreover, the feeling of the hide of **** cannot be obtained. Moreover, an ethylene content is less than 5.5% of copolymerization polypropylene, if it was in the resin constituent with the start temperature of crystallization generation of heat higher than the temperature calculated by the formula (1), when it is made a nonwoven fabric, it is slimy, admiration remains, the temperature whose heat weld is attained is also of the same grade compared with conventional copolymerization polypropylene, and heat weld intensity is also obtained only for a low thing. A nonwoven fabric is also inferior in flexibility and what is expected is not obtained.

[0010] Furthermore, if the ethylene content was in the resin constituent with the start temperature of crystallization generation of heat higher than the temperature which is less than 8.0% of 5.5% or more copolymerization polypropylene, and was calculated by the formula (1), when it is made a nonwoven fabric, it is slimy, admiration remains, the temperature whose heat weld is attained is also of the same grade compared with conventional copolymerization polypropylene, and heat weld intensity is also obtained only for a low thing. A nonwoven fabric is also inferior in flexibility and what is expected is not obtained. It is difficult to use it, since it is slimy when an ethylene content makes it a nonwoven fabric with the polypropylene of 8.0% or more of copolymerization, and admiration remains and the intensity of a nonwoven fabric becomes weak.

[0011] If the rate of fatty-acid flax id [the silicas as an additive and] added to polypropylene resin increases, the crystallization exoergic start temperature as a polypropylene resin constituent will fall. As an addition of the silica in this case, it is 0.01 - 3.0%, and is 0.05 - 2.0% preferably. It is 0.1 - 1.0% still more preferably. At less than 0.01%, the start temperature of crystallization hardly changes. Moreover, conversely, at 3.0% or more, spinning nature becomes bad and it becomes impossible stable to spinning fabricate it. Moreover, as fatty-acid flax id, less than 3.0% 0.01% or more is desirable, and it is less than 2.0% 0.05% or more preferably. It is less than 1.0% 0.1% or more still more preferably. At less than 0.01%, it becomes impossible conversely to spinning fabricate [spinning nature became bad and was stabilized at 3.0% or more fabricating] the start temperature of crystallization. Although it is effective even if it uses these silicas and fatty-acid flax id independently respectively, the effect can be further increased by using together silicas and fatty-acid flax id.

[0012] such a polypropylene resin constituent -- the heat weld fiber as monolayer fiber -- or -- and although it can be used as a heat weld nonwoven fabric manufactured, it is good also as compound heat weld fiber, such as sheath-core type fiber and parallel-connected-type fiber, in fiber, such as polypropylene resin which can demonstrate an effect if this resin constituent is exposed to a fiber front face in part, and does not contain this resin constituent, silicas, and fatty-acid flax id at all If it is sheath-core type fiber and is a sheath component and parallel-connected-type fiber, it is effective to use it as a low melting point component.

[0013] [Function] although the resin constituent which blended silicas or fatty-acid flax id with polypropylene resin was widely used in the film field, the purpose is reservation of the opening nature of a film, and the purpose of improvement of transparency, and there was almost nothing that is used for the raw material for fiber When silicas or fatty-acid flax id are added to polypropylene resin, this invention is based on having found out that heat weld was possible at low temperature, though manufacture is easy monolayer fiber for that crystallization exoergic temperature falls and this reason. Consequently, this invention reduces the comonomer content which gives a feeling of slime as polypropylene resin, and it enables low-temperature heat weld for cheap monolayer fiber, using the raw material which has admiration entirely.

[0014]

[Example]

To the polypropylene (MFR=7.5g /, 10 minutes, and density =0.90 g/cm³) of the gay of example-1 base polymer, 0.1 % of the weight of erucic-acid flax id was added, it kneaded and pelletized by the monopodium screw extruder, subsequently cooling according that by which melting extrusion was carried out using the melt spinning equipment of 40mmphi to a cross wind was performed, and it was made fiber of 5.6 deniers of single yarn. Then, the crimp was given by the crimper with a temperature of about 140 degrees C depended on a stuffing-box type, and fiber was cut to 5cm length. The cut staple fiber was covered over the card, the web with a thickness of about 2mm was created, heat weld was carried out by the air oven by the dry type circulation air by which the temperature control was carried out to **2 degrees C, and creation of a heat weld nonwoven fabric was tried. The heat weld nonwoven fabric was evaluated according to the appraisal method shown below. The result is shown in Table 1.

[0015] (1) After carrying out the temperature up to 200 degrees C by part for 10-degree-C/in speed and keeping temperature constant for 5 minutes using the crystallization temperature DSC (Differential Scanning Calorimetry), the elevated temperature was carried out to 50 degrees C by part for 10-degree-C/in speed, the base line was pulled on the crystallization exoergic curve, and crystallization start temperature was measured.

(2) Temperature was raised for every heat weld temperature of 1 degree C, the existence of heat weld of fiber was investigated, sufficient heat weld took place and the minimum of the temperature which can manufacture a nonwoven fabric was investigated. In addition, although it did not measure since quantification of weld intensity was difficult, and the nonwoven fabric of this invention is qualitative, what has high heat weld temperature is obtained.

[0016] (3) Because of quantification of a feeling of dynamic-friction-coefficient slime, cut the heat weld nonwoven fabric obtained at the minimum temperature by the above-mentioned heat weld thermometry in width [of 100mm] x length of 200mm, and it is on a test piece (one sheet). n= 3-5 sheets are prepared by making the bottom of a test piece (one sheet) into a lot, it sets to the constant temperature of the temperature of 23 degrees C, and 50% of humidity, and the constant humidity interior of a room, and they are after 24 or more hrs state adjustment and ASTM. Based on D-1894, in a touch-area width x length of 80mm, slide speed 50 mm/min and 800g of loads were put with the low-speed type surface slide measurement machine, and the dynamic friction coefficient of nonwoven fabrics was

Coefficient of friction = (Resistance g) / load of a chart (800g)

[0017] (4) It classified into four stages which show the feeling of a heat weld nonwoven fabric below by the tactile feeling touch.

A: It is very flexible, and there is no feeling of slime, and there is tactile feeling like the hide of ****.

B: Although there is no feeling of slime, it is inflexible and there is tactile feeling like a film.

C: Although it is flexible, think that there is a feeling of slime and it adheres to the skin.

D: It is inflexible and there is a feeling of slime.

(5) Continuous running was performed for spinning stability 24 hours, and that to which the number of times of thread breakage exceeds 2 times was made improper.

[0018] The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having replaced with the example-2 erucic-acid flax id, and having added the silicon dioxide of about 2.7 micrometers of secondary particle diameters 0.1% of the weight. The result is shown in Table 1.

In the method of example -3 example -1, the same method estimated by creating a heat weld nonwoven fabric except [all] having added the erucic-acid flax id 0.8% of the weight. The result is shown in Table 1.

In the method of example -4 example -1, the same method estimated by creating a heat weld nonwoven fabric except [all] having added the silicon dioxide which replaced with the erucic-acid flax id and was used in the example 2 0.8% of the weight. The result is shown in Table 1.

In the method of example -5 example -1, the same method estimated by creating a heat weld nonwoven fabric except [all] having added the silicon dioxide which used the erucic-acid flax id in 0.2 % of the weight and the example 2 0.8% of the weight. The result is shown in Table 1.

In the method of example -6 example -1, the same method estimated by creating a heat weld nonwoven fabric except [all] having added the silicon dioxide which used the erucic-acid flax id in 0.8 % of the weight and the example 2 0.2% of the weight. The result is shown in Table 1.

[0019] The same method as an example -5 estimated by creating a heat weld nonwoven fabric except [all] having used random copolymerization polypropylene (MFR=9.0g /, 10-minute, and ethylene content 4.2% and density =0.90 g/cm³) as example-7 base polymer. The result is shown in Table 1.

The same method as an example -6 estimated by creating a heat weld nonwoven fabric except [all] having used random copolymerization polypropylene (MFR=9.0g /, 10-minute, and ethylene content 4.2% and density =0.90 g/cm³) as example-8 base polymer. The result is shown in Table 1.

The same method as an example -5 estimated by creating a heat weld nonwoven fabric except [all] having used random copolymerization polypropylene (MFR=10.2g /, 10-minute, and ethylene content 2.0% and density =0.90 g/cm³) as example-9 base polymer. The result is shown in Table 1.

[0020] The same method as an example -6 estimated by creating a heat weld nonwoven fabric except [all] having used random copolymerization polypropylene (MFR=10.2g /, 10-minute, and ethylene content 2.0% and density =0.90 g/cm³) as example-10 base polymer. The result is shown in Table 1.

The same method as an example -5 estimated by creating a heat weld nonwoven fabric except [all] having used random copolymerization polypropylene (MFR=24.4g /, 10-minute, and ethylene content 6.8% and density =0.89 g/cm³) as example-11 base polymer. The result is shown in Table 1.

The same method as an example -6 estimated by creating a heat weld nonwoven fabric except [all] having used random copolymerization polypropylene (MFR=24.4g /, 10-minute, and ethylene content 6.8% and density =0.89 g/cm3) as example-12 base polymer. The result is shown in Table 1.

[0021] The sheath-core type fiber which made **** the random copolymerization polypropylene used in the example -7 as example-13 base polymer, and made **** the polypropylene (MFR=7.5g /, 10 minutes, and density =0.90 g/cm3) of the gay who does not add silicas and fatty-acid flax id was produced, and the same method as an example -5 estimated by creating a heat weld nonwoven fabric except [all] having used as a material. The result is shown in Table 1.

The fiber which has arranged the random copolymerization polypropylene used in the example -7 as example-14 base polymer and the polypropylene (MFR=7.5g /, 10 minutes, and density =0.90 g/cm3) of the gay who does not add silicas and fatty-acid flax id to the parallel connected type was produced, and the same method as an example -5 estimated by creating a heat weld nonwoven fabric except [all] having used as a material. The result is shown in Table 1.

[0022]

[Table 1]

試料	動 機	熱 融 点	熱 融 形 状	糸 径	結 晶 化 速 度	シ リ カ 質	脂 肪 ア ミ ド	エ チ レ ン 含 量 (%)	ベ ー ス ポ リ マ ー	試 料 名
1	A	142	良 好	0.17	124.1	0	0.1	0	ホモPP	実 施 例 - 1
2	A	142	良 好	0.20	124.3	0.1	0	0	"	2
3	A	138	良 好	0.09	123.7	0	0.8	0	"	3
4	A	140	良 好	0.06	123.6	0.8	0	0	"	4
5	A	138	良 好	0.04	123.0	0.8	0.2	0	"	5
6	A	136	良 好	0.03	123.1	0.2	0.8	0	"	6
7	A	124	良 好	0.12	109.0	0.8	0.2	4.2	共 重 合 PP	7
8	A	124	良 好	0.08	108.7	0.2	0.8	4.2	"	8
9	A	129	良 好	0.08	111.2	0.8	0.2	2.0	"	9
10	A	128	良 好	0.07	111.7	0.2	0.8	2.0	"	10
11	A	126	良 好	0.15	94.2	0.8	0.8	6.8	"	11
12	A	126	良 好	0.16	93.8	0.2	0.8	6.8	"	12
13	A	124	良 好	0.12	109.0	0.8	0.2	4.2	共 重 合 PP (細) / ホモPP (粗)	13
14	A	146	良 好	0.51	127.2	0	0.2	4.2	共 重 合 PP (粗) / ホモPP (細)	14
	A	124	良 好	0.12	109.0	0.8	0.2	4.2	共 重 合 PP (粗) / ホモPP (細)	
	A	146	良 好	0.51	127.2	0	0.2	4.2	共 重 合 PP (粗) / ホモPP (細)	

[0023] The same method as an example -6 estimated by creating a heat weld nonwoven fabric except [all] having carried out without adding silicas and fatty-acid flax id using a gay's polypropylene (MFR=7.5g /, 10 minutes, and density =0.90g/cm3) as example of comparison-1 base polymer. The result is shown in Table 2.

The same method as an example -6 estimated by creating a heat weld nonwoven fabric except [all] having carried out without adding silicas and fatty-acid flax id using random copolymerization polypropylene (MFR=9.0g /, 10-minute, and ethylene KONRENTO 4.1% and density =0.90 g/cm3) as example of comparison-2 base polymer. The result is shown in Table 2.

The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having carried out without adding silicas and fatty-acid flax id using random copolymerization polypropylene (MFR=24.4g /, 10-minute, and ethylene KONRENTO 6.8% and density =0.89 g/cm3) as example of comparison-3 base polymer. The result is shown in Table 2.

[0024] The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having added example of comparison-4 erucic-acid AMAIDO 0.005% of the weight, and having not added silicas. The result is shown in Table 2.

The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having added example of comparison-5 erucic-acid AMAIDO 4.0% of the weight, and having not added silicas. The result is shown in Table 2.

[0025] The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having added the silicon dioxide used in the example of comparison -6 example 2 0.005% of the weight, and having not added fatty-acid AMAIDO. The result is shown in Table 2.

The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having added the silicon

dioxide used in the example of comparison -7 example 2 4.0% of the weight, and having not added fatty-acid AMAIDO. The result is shown in Table 2.

The same method as an example -1 estimated by creating a heat weld nonwoven fabric except [all] having added 0.005 % of the weight of erucic-acid AMAIDO, and having added the silicon dioxide used in the example 2 4.0% of the weight, using random copolymerization polypropylene (MFR=9.0g /, 10-minute, and ethylene KONRENTO 4.1% and density =0.90 g/cm³) as example of comparison-8 base polymer. The result is shown in Table 2.

[0026]

[Table 2]

比較例	ベースポリマー	エチレン含量 (%)	脂肪アミド	シリカ濃度	結晶化開始温度 (°C)	安定性	繊維形状	熱融温度	伸張率	試験
比較例-1	ホモPP	0	0	0	127.2	良好	糸状繊維	146	0.51	B
2	共重合PP	4.2	0	0	122.2	良好	糸状繊維	136	0.78	D
3	"	6.8	0	0	103.6	良好	糸状繊維	134	0.89	C
4	ホモPP	0	0.005	0	127.3	良好	糸状繊維	146	0.40	B
5	"	0	4.0	0	123.0	不可	糸状繊維	134	0.05	A
6	"	0	0	0.005	127.5	良好	糸状繊維	146	0.47	B
7	"	0	0	4.0	122.8	不可	糸状繊維	134	0.06	A
8	共重合PP	4.2	0.005	4.0	109.4	不可	糸状繊維	130	0.03	A

[0027]

[Effect of the Invention] Excluding toxic substances, such as and, a binder, etc. with the soft and sufficient touch, the heat weld nonwoven fabric manufactured polypropylene system heat weld fiber and from now on has heat weld nature, and since it excels in processability, it is widely used for a paper diaper and product fields mass-produced, such as napkin etc. And since heat weld is attained at low temperature, as a manufacturing process, the nonwoven fabric manufactured from compound-die fiber, such as complicated **** type structure fiber or parallel-connected-type structure fiber, or it is used in many cases using the resin of a high-melting point, and the resin of the low melting point.

[0028] Even if this invention is monolayer fiber from the resin constituent which added silicas and/or fatty-acid AMAIDO for this to polypropylene resin, it is soft, even if it is the case where low-temperature heat weld is performed, its weld intensity is high, and has the touch carried out entirely and can manufacture heat weld fiber and a heat weld nonwoven fabric excellent in processability. For this reason, these fiber or the nonwoven fabric is excellent in processability, and can be used as a high material of productivity. Of course, although a manufacturing process becomes complicated, you may use it with a high-melting point or the resin of the low melting point from this resin constituent as a compound-die fiber raw material of **** type structure or parallel-connected-type structure.

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CLAIMS

[Claim(s)]

[Claim 1] To polypropylene resin, silicas and/or fatty-acid AMAIDO are added 0.01 to 3.0% of the weight, and the start temperature (TCS (degree C)) of crystallization generation of heat is the following formula (1).

$TCS (\text{degree C}) = (0.094CE^2 - 4.13CE + 127) \text{ ** } \dots (1)$

(however CE are ethylene content %, and are $0 \leq CE \leq 8\%$. Polypropylene system heat weld fiber using the resin constituent which it is calculated by), depends and is low temperature.

[Claim 2] Polypropylene system heat weld fiber according to claim 1 whose silicas are silicon dioxides or natural silicas with a grain size of 50 micrometers or less.

[Claim 3] Polypropylene system heat weld fiber according to claim 1 whose fatty-acid AMAIDO is a kind of fatty-acid [at least] AMAIDO chosen from erucic-acid AMAIDO, oleic acid AMAIDO, or stearin acid AMAIDO.

[Claim 4] The polypropylene system heat weld nonwoven fabric manufactured from the polypropylene system heat weld fiber of claims 1-3.

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